

WHAT IS CLAIMED IS:

1. An electron-emitting device comprising a substrate, first and second carbon films disposed so as to have a first gap between the first and second carbon
5 films on a surface of the substrate, and first and second electrodes electrically connected with the first and the second carbon films respectively, wherein

the carbon film has a region showing orientation, and the direction of the orientation is an
10 approximately parallel to the surface of the substrate surface.

2. An electron-emitting device comprising a substrate, first electrode and second electrodes
15 disposed on a surface of the substrate, and a carbon film electrically connected to the first and second electrodes, wherein

the carbon film has a first gap at a portion in itself, and has a region showing orientation, and the
20 direction of the orientation is the approximately parallel to the surface of the substrate surface.

3. The electron-emitting device according to claim 1 or 2, wherein the direction of the orientation
25 is not less than -45 degrees and not more than +45 degrees against the substrate surface.

4. The electron-emitting device according to claim 1 or 2, wherein the region showing orientation faces the first gap.

5 5. The electron-emitting device according to claim 4, wherein said region showing orientation is disposed in the region of the distance of not more than 100 nm from the end portion of said carbon film facing said first gap toward the direction of said electrodes.

10 6. The electron-emitting device according to claim 1 or 2, wherein said carbon film further has a region orientated in an approximately normal direction against said substrate surface.

15 7. The electron-emitting device according to claim 6, wherein said approximately normal direction is not less than -30 degrees and not more than +30 degrees from normal direction against said substrate surface.

20 8. The electron-emitting device according to claim 6, wherein the region orientated in said approximately normal direction is disposed between the region orientated in said approximate parallel direction and said electrodes.

25 9. The electron-emitting device according to

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claim 6, wherein said carbon film has a region without
any particular orientation, and said region without any
particular orientation is disposed between the region
orientated in said approximate parallel direction and
5 the region orientated in said approximately normal
direction.

10 10. The electron-emitting device according to
claim 1 or 2, wherein said carbon film and the first
and the second electrodes are connected via a
conductive film.

15 11. An electron source comprising a plurality of
electron-emitting devices which have been arranged and
formed on a substrate, wherein the electron-emitting
device is the electron-emitting device according to
claim 1 or 2.

20 12. An image forming apparatus comprising an
electron source and an image forming member forming
images with electrons to be emitted from the electron
source being radiated, wherein the electron source is
an electron source according to claim 11.

25 13. An electron-emitting device comprising:
a substrate;
first and second electrodes respectively having

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been disposed on the substrate surface;

first and second conductive films having a second gap disposed between said electrodes and respectively connected with said and the second electrode;

5 first and second carbon films having a first gap within said second gap and disposed so as to be respectively connected with said first and the second conductive film; wherein

10 said first and the second carbon film respectively covers a part of said first and the second conductive film, and

the carbon film disposed on said conductive film has a region showing orientation, and a direction of the orientation is approximately normal direction
15 against said substrate surface.

14. An electron-emitting device comprising:
a substrate;

20 first and second electrodes respectively having been disposed on said substrate surface;

a conductive film connected with said both electrodes and having a second gap disposed in one portion of itself;

25 a carbon film connected with said conductive film and having a first gap in one portion of itself; wherein

said first gap is disposed inside said second gap,

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and said carbon film has, on said conductive film, a region showing orientation, and a direction of the orientation is approximately normal direction against said substrate surface.

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15. The electron-emitting device according to claim 13 or 14, wherein the direction is not less than -30 degrees and not more than +30 degrees against the substrate surface.

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16. The electron-emitting device according to claim 13 or 14, wherein said carbon film further has a region orientated in the approximately parallel direction to said substrate surface.

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17. The electron-emitting device according to claim 16, wherein said approximately parallel direction is not less than -45 degrees and not more than +45 degrees along said substrate surface.

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18. The electron-emitting device according to claim 16, wherein the region orientated in said approximate parallel direction faces said first gap.

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19. The electron-emitting device according to claim 16, wherein said region orientated in said approximate parallel direction is disposed in the

region of the distance of not more than 100 nm from the end portion of said carbon film facing said first gap toward the direction of said electrodes.

5 20. The electron-emitting device according to claim 16, wherein the region orientated in said approximately normal direction is disposed between the region orientated in said approximate horizontal direction and said electrodes.

10 21. An electron-emitting device according to claim 16, wherein said carbon film has a region without any particular orientation, and said region without any particular orientation is disposed between the region
15 orientated in said approximate horizontal direction and the region orientated in said approximately normal direction.

20 22. An electron source comprising a plurality of electron-emitting devices which have been arranged and formed on a substrate, wherein the electron-emitting device is the electron-emitting device according to any of claim 13 or 14.

25 23. An image forming apparatus comprising an electron source and an image forming member forming images with electrons to be emitted from the electron

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source being radiated, wherein the electron source is
an electron source ~~according~~ according to claim 22.